A New Low-Fat Cheese

BYRON H. WEBB

Make a flavorful full-bodied cheese from the cow's milk protein which now supplements butterfat in all of our best cheese. This was the assignment received by two Agricultural Research Service scientists. Casein, our most highly nutritious protein and the principal protein of milk and all of the gourmet cheeses, had never been successfully molded into an edible cheese without its companion milk component, butterfat. The diet-conscious American public was becoming increasingly protein conscious and also was looking for low-fat foods.

The two scientists, R. E. Hargrove and F. E. McDonough, realized that the source of flavor in our finest cheeses was the fat and the products derived from fat by the bacteria that develop cheese flavor. If flavor were proportional to fat content, who would eat a cheese without fat and flavor?

There are 400 varieties of cheese—one for every day in the year and some to spare. Why make another, especially since skim milk cheese is already manufactured? The answer is obvious to anyone who tries to bite into a flavorless, hard, rubberlike chunk of skim milk cheese which contains mostly protein with no fat and little water. This kind of product is made to be shredded for food manufacture. When dry, its protein, casein, is a horny, tough, brittle substance, a material from which plastics and fibers can be made. Moisture softens it to a rubbery mass. Too much water provides ideal conditions for spoilage. Clearly, here was a research problem needing the creative skills, imagination, and hard work of the milk technologist, microbiologist, and chemist.

Nutritionists' praise for cheese is based largely on its high content of milk protein—the best balanced natural protein we know. Cheese also is an important source of calcium. This essential mineral is held in the curd which is coagulated by rennet during the cheesemaking process. Other less important soluble salts such as sodium are drained off in the whey. Milk fat is regarded nutritionally as one of our finest fats.

Fat and water contribute flavor and a soft, pliable body to cheese. The low-fat cheese researcher must produce both flavor and an acceptable body without the fat. He must build water into the system as a readily available softening agent; but high water content permits an undesirable bacterial activity and it is conducive to poor keeping quality. The soft and mellow body of normal cheese is produced during ripening, a period of slow biochemical breakdown of fats and proteins. Here, the essential catalysts are the enzyme systems provided by continuous microbial activity.

The problem faced by Hargrove and McDonough was how to eliminate the fat from cheese, substituting for it water and protein. They must encourage bacterial breakdown to produce flavor and softness, but maintain suitable keeping quality.

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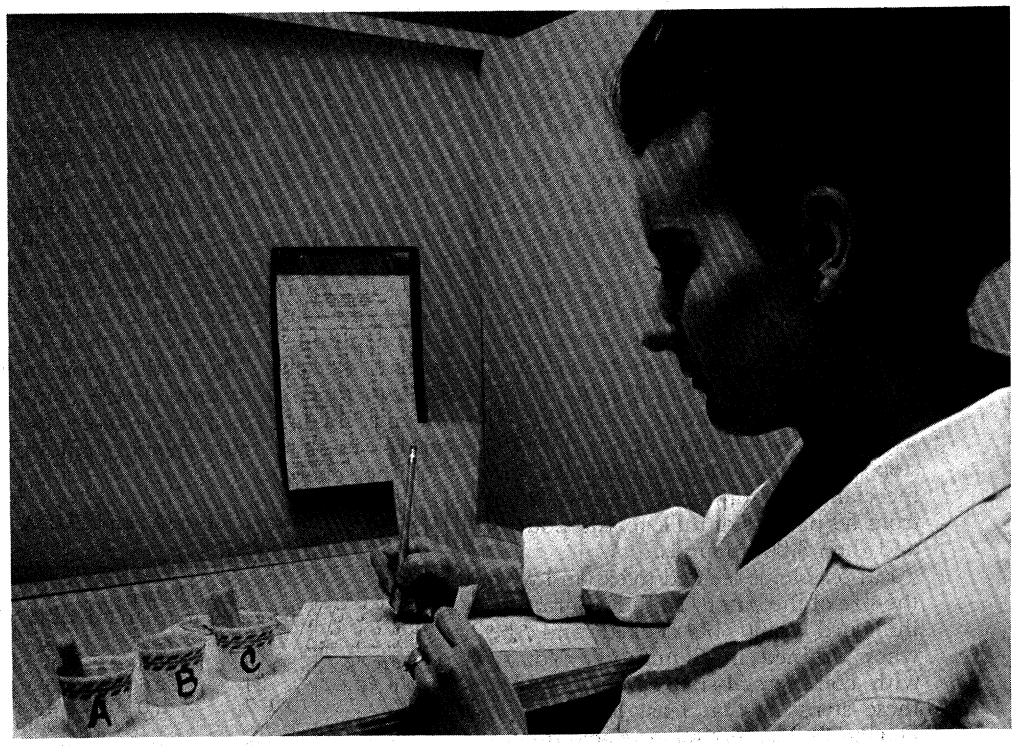
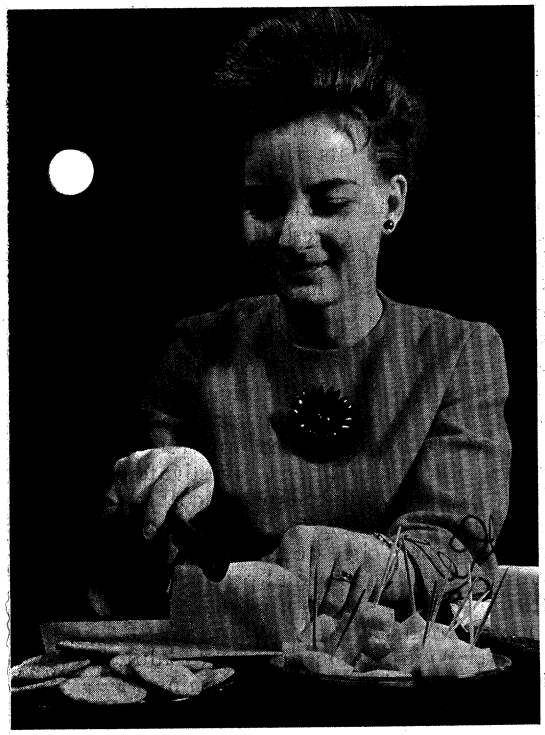
Cheese varieties.

Cheese is made in large vats holding thousands of pounds of milk to which acid-forming, flavor-producing, body-softening bacteria must be added to help rennet coagulate the milk. The curd that forms after a few hours is cut and heated. This cooking liberates whey from the shrinking curd just as water is pressed from a wet sponge. The firming curd is gathered together, salted, and placed in molds to cure 2 to 8 months, producing mellow, flavorful cheese. Research on cheese means trying, testing, failing, and starting anew, making hundreds of tests with thousands of pounds of milk. To save on time and materials, Hargrove and McDonough devised an experimental procedure to make batches of cheese with only 50 pounds of milk.

Cheddar cheese is made from milk containing 3.5 percent fat. The new skim milk cheeses were made from milks containing from 0.1 to 1 percent fat, and it was found that 0.7 of 1 percent was optimum under the researchers' experimental conditions. But to produce flavor, something unusual must be done. Could some kind of additive be used? Of many tried, none were judged fully acceptable. Perhaps the fat itself could be made to give up more than its usual amount of flavor. What about various pretreatments of the milk? Homogenization proved particularly effective in subdividing the fat, making it accessible to the fat-splitting enzymes in the milk. And this greatly improved the flavor in the cured cheese.

The puzzle of how to handle moisture had to be resolved. The more water incorporated in the cheese protein, the softer and more tender would be its body. But the superb ripening and keeping quality of commercial cheese derives from its delicate balance of water, salt, and bacterial food. These enable flavor-producing bacteria to grow, discouraging the spoilage





Trained taste panel evaluation, *above,* of EUDA cheese. *Left,* preparing for consumer acceptance test of the new cheese.

organisms. Hargrove and McDonough tried many moisture levels from the 38 percent of Cheddar cheese to the 70 percent of Schmierkäse, which actually liquefies in ripening. But high moisture leads to instability, and so Schmierkäse cheese quickly deteriorates in storage. Finally, using their new process, the researchers found the best moisture level to be 57 to 59 percent. They were now producing an attractive, new, and flavorful semisoft skim milk cheese in the laboratory.

At the Agricultural Research Center at Beltsville, a pilot plant team, H. E. Walter, A. M. Sadler, and W. A. Mattingly, was tooling up for the next step—experimental production in commercial-size equipment. Batches grew from 50 pounds of milk to 100 pounds and then 3,000 pounds.

But problems seemed to expand with the size of the batch. In the laboratory, the curd could be cooked and the whey drained in 5 minutes. Not so with commercial-size batches, where these steps took at least 30 minutes. During that time, excessive acid quickly developed in the curd. To control this, adjustment was made in the amount of bacterial starter added to the milk and in the rate of cooking and cooling the curd. Other adjustments were made, and finally a skim milk cheese comparable to the laboratory product was produced in the pilot plant. The Beltsville pilot plant would be capable of producing hundreds of pounds of low-fat cheese for consumer and market testing.

Next, the new cheese must have a name to identify it in the marketplace. The researchers thought of their product as "low-fat cheese" which indicated it contained less fat than ordinary cheese. Skim milk containing 0.6 or 0.7 percent fat was actually the raw material used in its manufacture. In consultation with the Food and Drug Administration, the product was classified as a "semisoft skim milk cheese." To identify the cheese for consumers, it was named EUDA (pronounced uda) for "Eastern Utilization—Department of Agriculture."

EUDA cheese contains only 6 percent fat compared to 33 percent for Cheddar. Its moisture and salt content is also higher than Cheddar. But of most significance is the protein content of EUDA cheese, which is 30 percent while that of Cheddar is 24 percent.

Here is a cheese of unusually high nutritive value with more protein on a pound-for-pound basis than any of the well-known cheeses. Even cottage cheese, the classic example of a high-protein product, contains less than 14 percent protein. The ratio between the two most important cheese components, fat and protein, is more favorable in skim milk cheese than in the other cheeses.

Analyses of Cheddar, Cottage, and EUDA Cheese

	Cheddar	*Cottage (creamed)*	*EUDA*
Fat %.....	33	4. 2	6
Moisture %..	38	78. 3	56
Protein %...	24	13. 6	30
Salt %.....	1. 7	1. 0	2. 4
Calories per 100 g..	398	106	185

EUDA cheese is mild, but attractive in flavor, although it does not have the well-ripened, full flavor of an aged Cheddar. The new cheese is semisoft, but because of its short period of ripening, its body is more pliable and less mellow than Cheddar. Flavor and body of EUDA cheese develop in a few weeks at refrigerator temperature (40° F.). Its shelf life under normal refrigeration is about 60 days, so that some control of distribution time will be necessary. EUDA cheese has four times the shelf life of cottage cheese, which is considered to be 15 days.

Spurred by consumer interest in cheese of low fat content, investigators in at least two of the State agricultural experiment stations recently have made excellent cheese containing about half the fat of the normal products. At the University of Minnesota Experiment Station, H. A. Morris and S. T. Coulter have produced Port du Salut, Brick, and Swiss cheeses containing 14

to 20 percent fat. Consumer acceptance of these has been excellent as judged by actual sales.

At Iowa State University, G. W. Reinbold and F. M. Madsen made Cheddar, Colby, and Swiss cheese containing one-half to two-thirds the fat content of the normal cheese. They found these to have very high consumer acceptance.

The technical problems of making cheese with less fat than that of normal cheese are being rapidly resolved. The American consumer will soon find in our markets cheese to suit any taste. Of special interest to weight watchers will be EUDA semisoft skim milk cheese which will keep fat intake low, but at the same time will satisfy a craving for good cheese.